



High Reliability Safety Systems for Emergency Response in the Built Environment

Walter W. Jones

Paul A. Reneke

Fire Research Division

**National Institute of Standards and
Technology**

Improve Information Transfer: When, Where and How

- **What**
 - Use knowledge of extreme events
 - Insure all systems are functioning as intended
- **How**
 - Use the signals from sensors to extract the actual environment (metrology)
 - Incorporate our understanding of fire science to translate this knowledge (modeling and prediction)
- **Implementation**
 - Standard interface for maintenance and response

Improve Information Transfer: When, Where and How

- **Questions for Focus Groups**

What do you want to know?

When do you want to know it?

Where do you want to know it?

How can it best be presented?

Fire Service Needs

- **At Dispatch**

- Confidence in alarm, size and growth rate of the fire

- **On Arrival**

- Location of the fire, the occupants, current conditions

- How to get to the fire

- Staging areas, standpipes, other resource or safety issues

- **During the Incident**

- Fire spread and growth, area(s) involved

- Systems status, i.e., ventilation

- Location of fire fighters

- Controls for communications and ventilation

Our interpretation of reliable incident management

- **Initial systems report**

Systems active and operating

Areas occupied

- **Incident management information**

Current and “look ahead” conditions

- **Intuitive interface**

High Resolution – building management, firehouse, ...

Panel – building panels, laptop/truck

Handheld – walkaround with Palm VII

A Possible Solution: The Advanced Fire Service Interface

- **Components**

Gather sensor data from buildings

- Simplex – NIST buildings
- Edwards – laboratory

Generate html pages

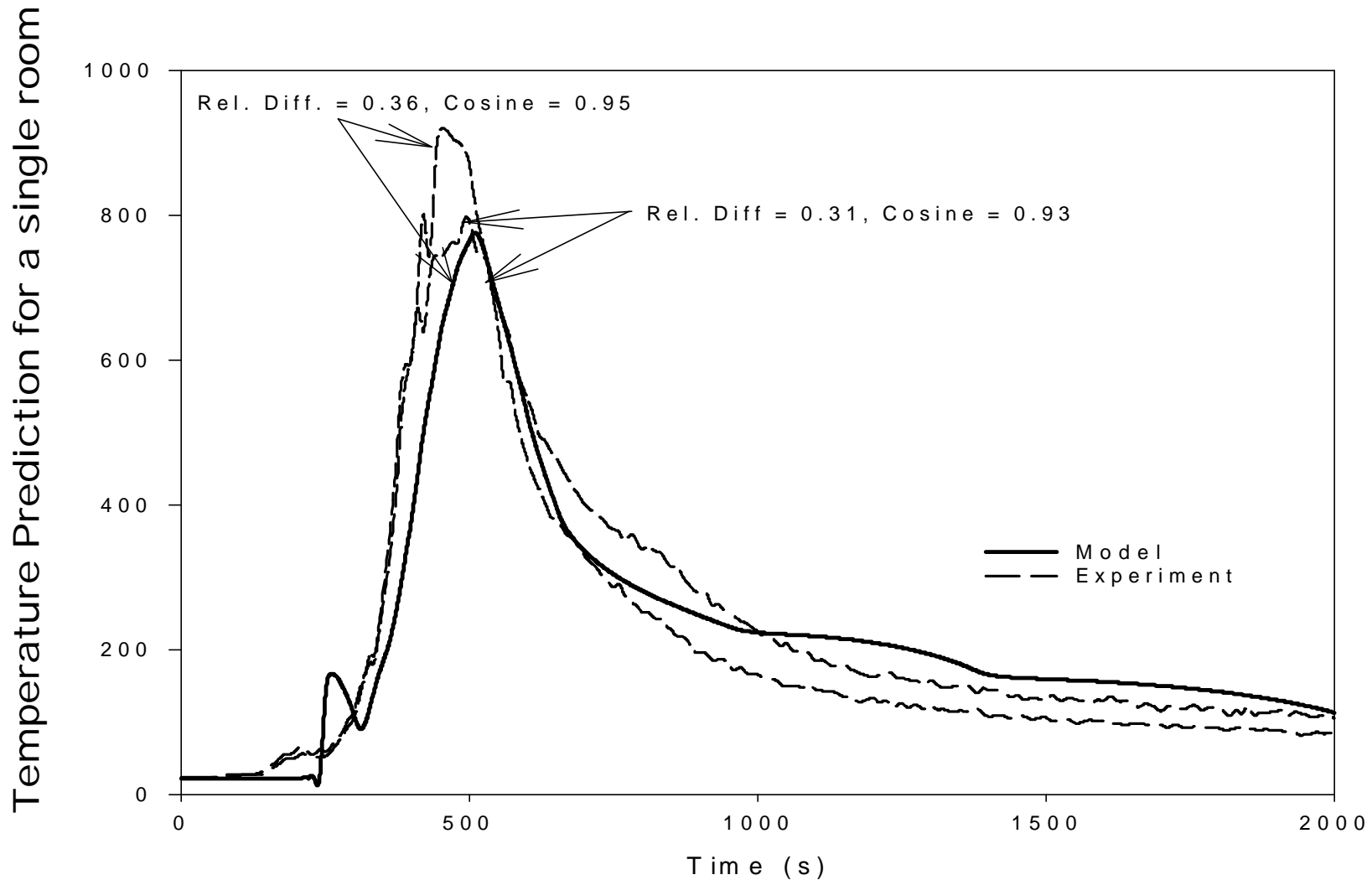
Delivery of information (accessible where needed)

- Wired lines
- Wireless

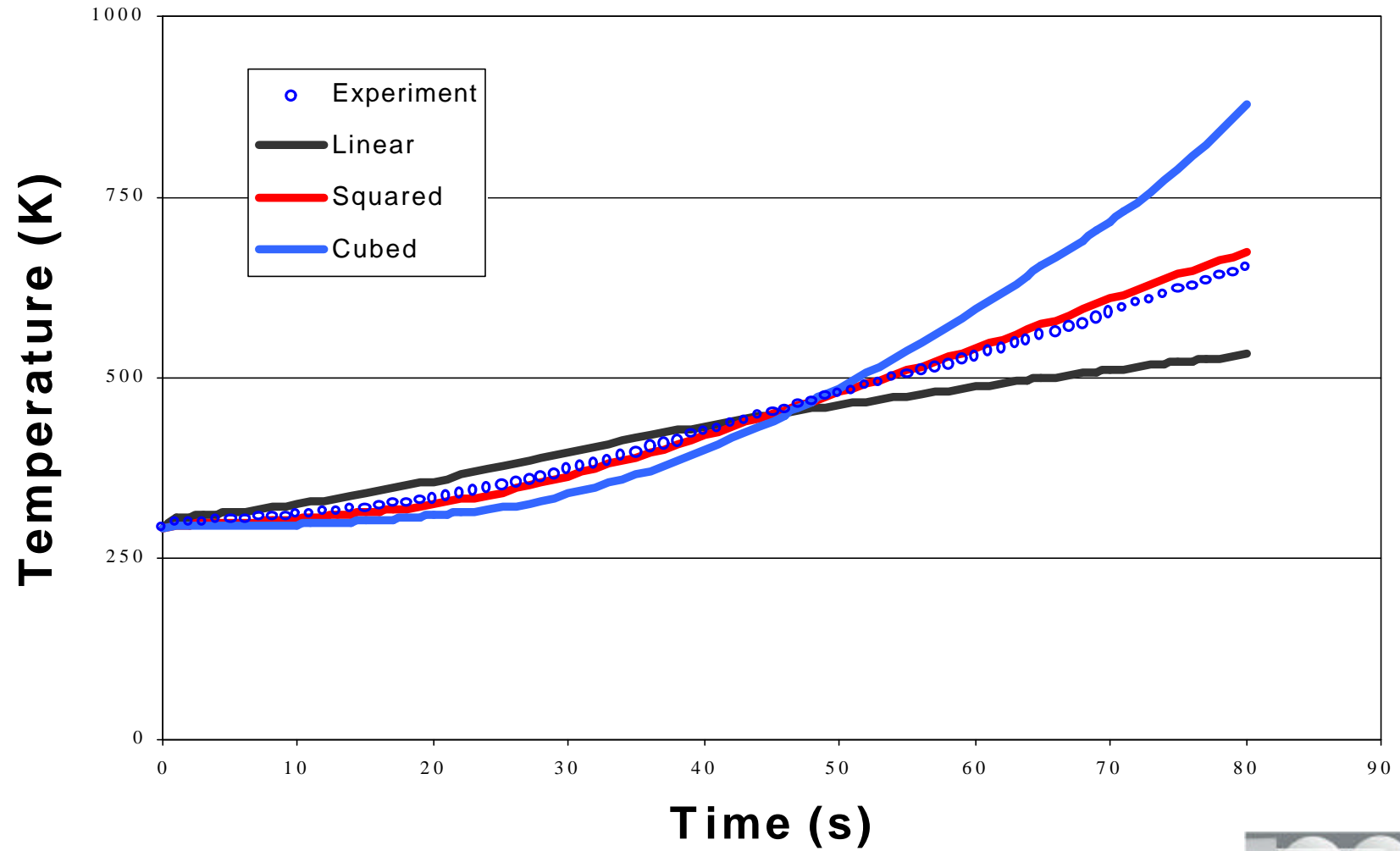
Devolves to four task

- **Reliability of the signal (is it a fire?)**
 - If yes, how big is it; that is, what is the threat?
- **Panel display – “information where it is needed”**
 - Fire service connection
 - Done by panel manufacturers (NIST/Industry Consortium)
- **Real time adaptive sensing**
 - Filter sensors and use simple algorithms
- **Orient our model to use sensor data to look ahead**
 - Tactical decision aid
 - Metric for the difference of measured and predicted
 - Shape and area differences

One of our real room comparisons

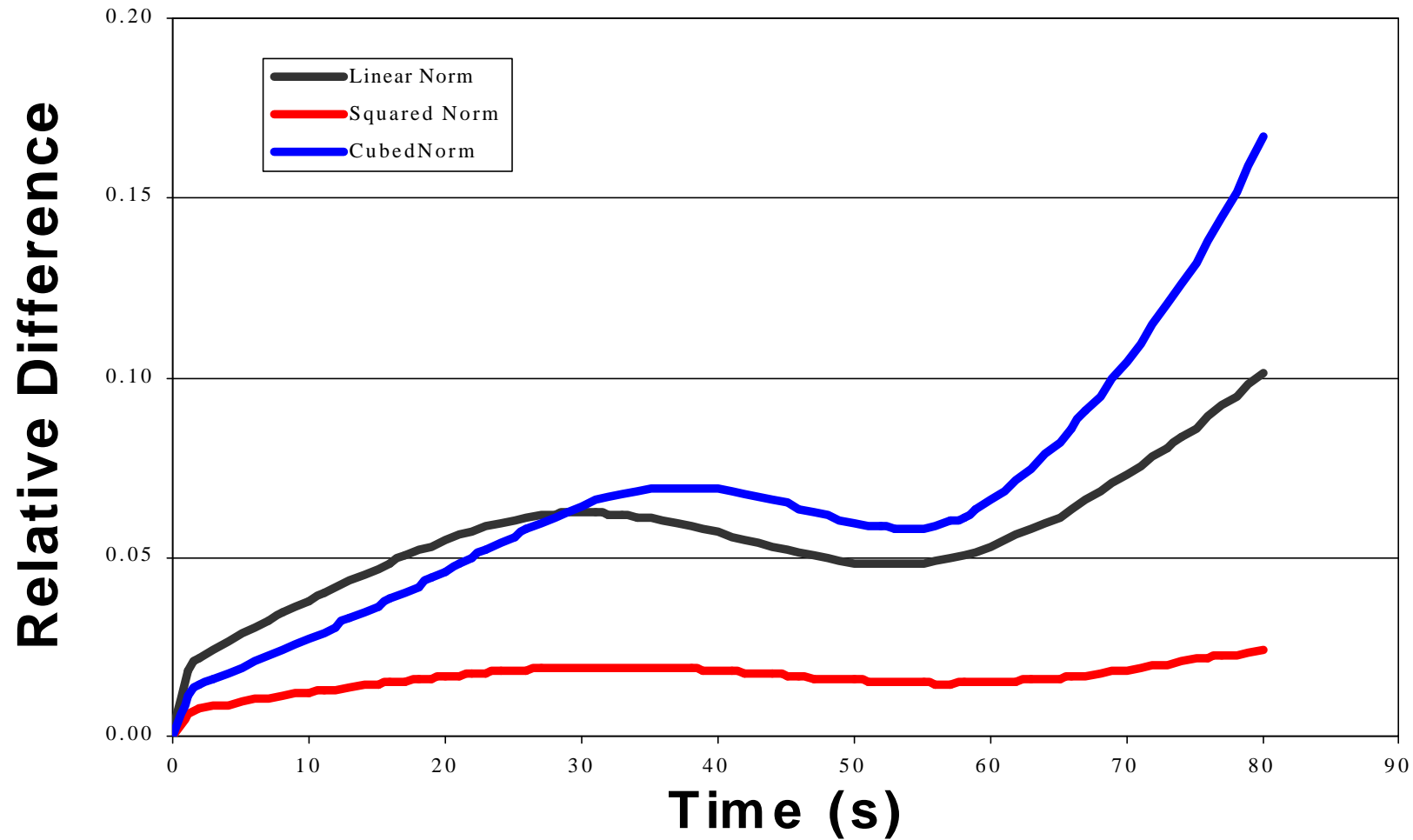


Using Sensor History to Predict Future Conditions



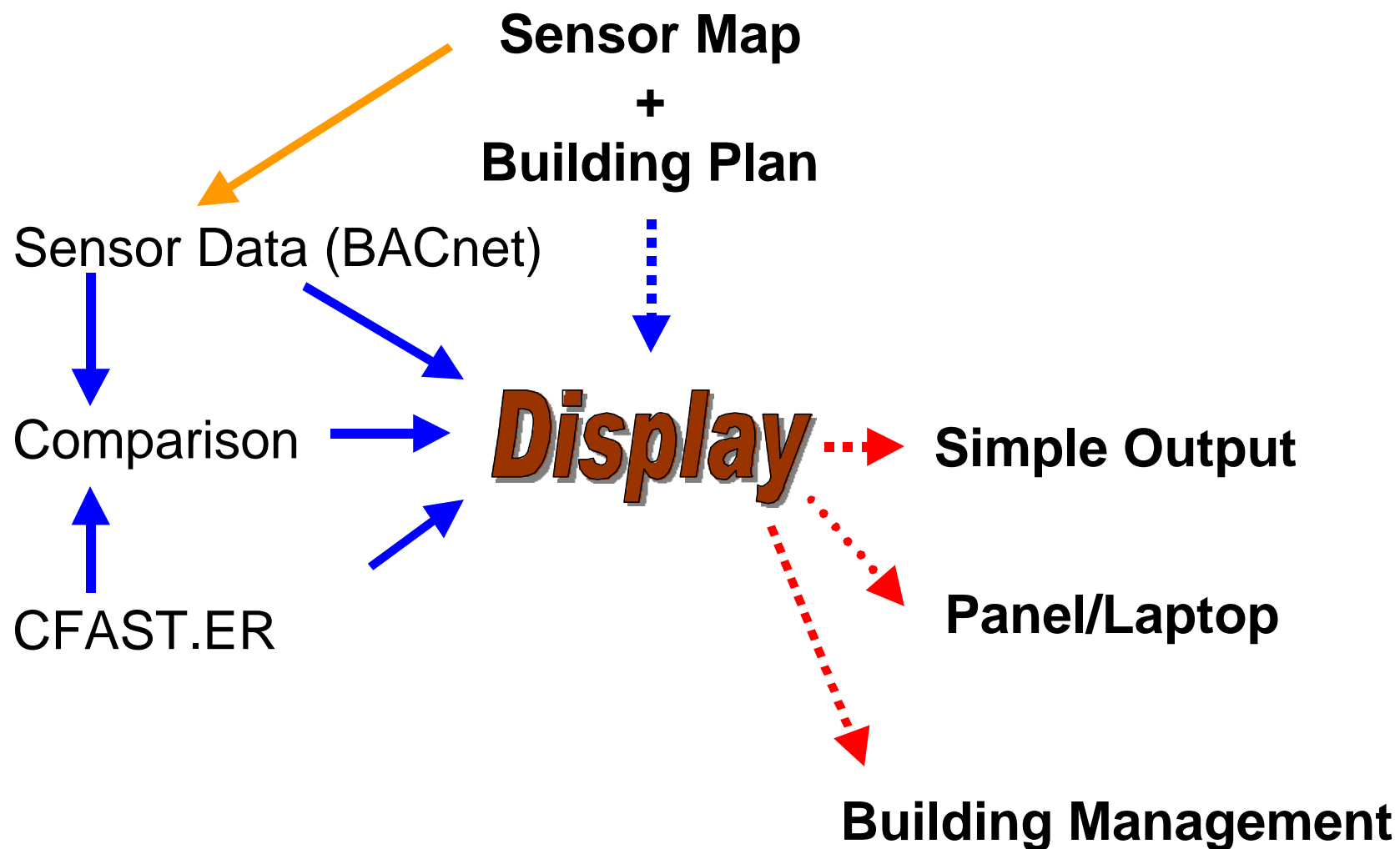
Research and Practice: Bridging the Gap, February 7-9, 2001, Orlando, Florida

Reliability of the Predictions



NFPA 72 Task Group

- Working groups
 - Icons (Usability, Color, Scaling)
 - Control functions
 - Information and presentation
- Proposal closing date was November, 2000
 - For code cycle 2002.
 - First it will be an appendix for 72



Delivery of Information

- **Building Management**

Building security, fire station, ...



- **Panel/Laptop**

Laptop “in the truck”

Building annunciator panel



- **Simple Display**

Handheld device



Layer Schematic

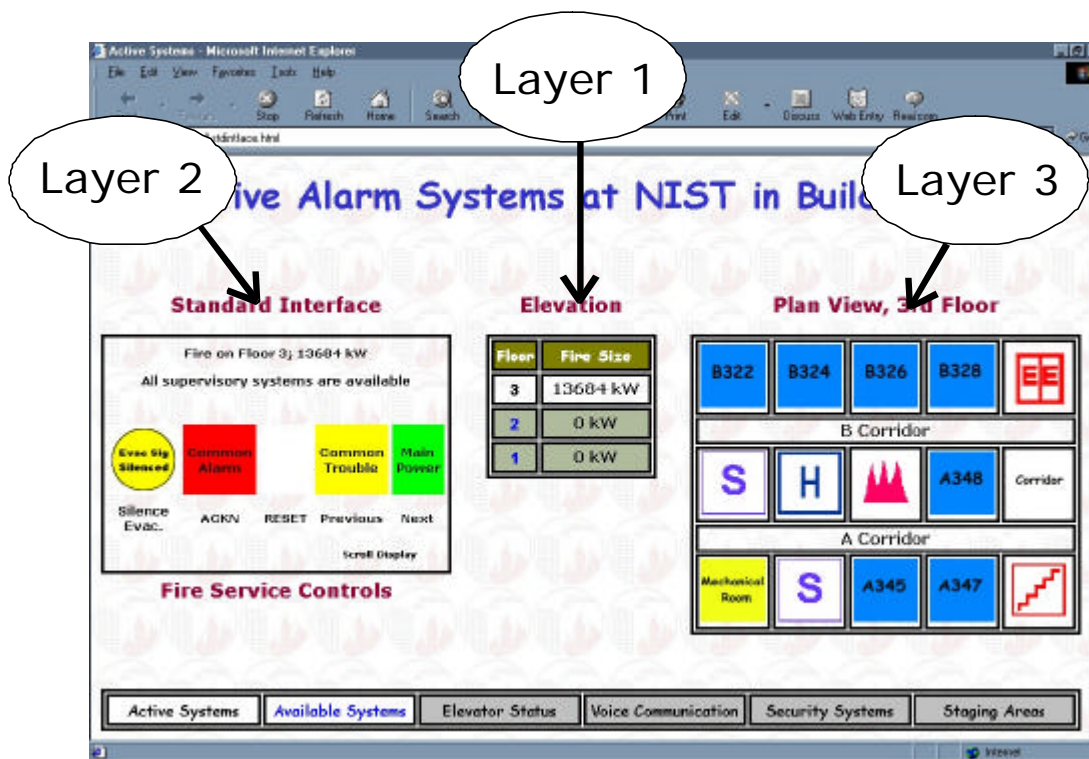






Illustration of the three layers for 1) text mode, 2) basic control panel for alarm systems, 3) building schematic for high resolution displays.

Prototype symbology for the various components of the building system

			
Smoke Detector	Heat Detector	Fire	Sprinkler

21 proposed at the moment - Usability issues remain

Active Alarm Systems at NIST in Building 224

Standard Interface

Fire on Floor 3; 13684 kW

All supervisory systems are available

Silence
Evac.

ACKN

RESET

Previous

Next

Scroll Display

Elevation

Floor	Fire Size
3	13684 kW
2	0 kW
1	0 kW

Plan View, 3rd Floor

B322	B324	B326	B328	
B Corridor				
			A348	Corridor
A Corridor				
Mechanical Room		A345	A347	

Fire Service Controls

Active Systems	Available Systems	Elevator Status	Voice Communication	Security Systems	Staging Areas
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The Layout in Building 224

Outside	Corridor	Experiment
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Active Systems - Netscape 8/23/2000 - 03:32 PM

File Edit View Go Communicator Help


Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: file:///I:/panel/active3.html02f3.html What's Related

Active Systems

Special Equipment

Camera in A 346



Building 224 Elevation

Floor	Fire Size
3	NA
2	NA
1	NA


Building 224, 3rd Floor

B322

B324

B326

B328



B Corridor

A342

A344


A346

A348

Corridor


A Corridor

Mechanical Room



A345

A347



Active Systems

Available Systems

Elevator Status


Voice Communication

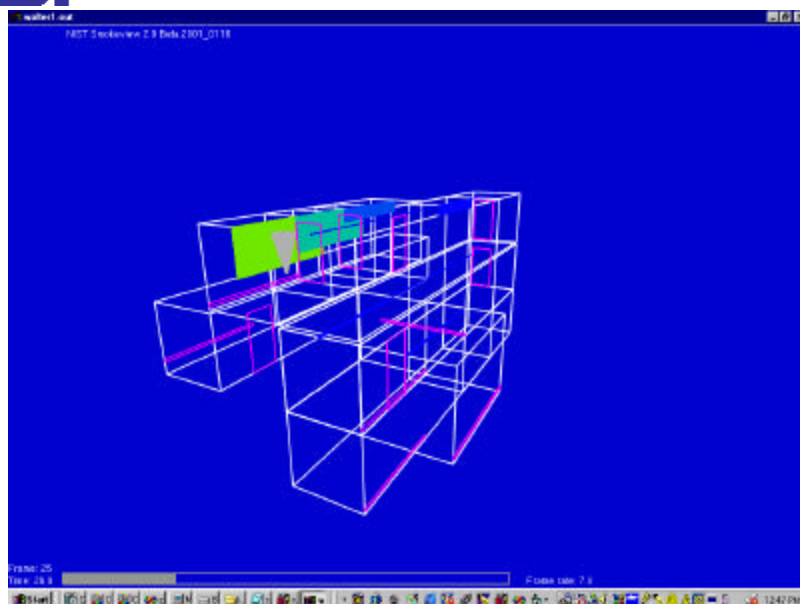
Building Security

Staging Areas

Current time : 3:32 PM

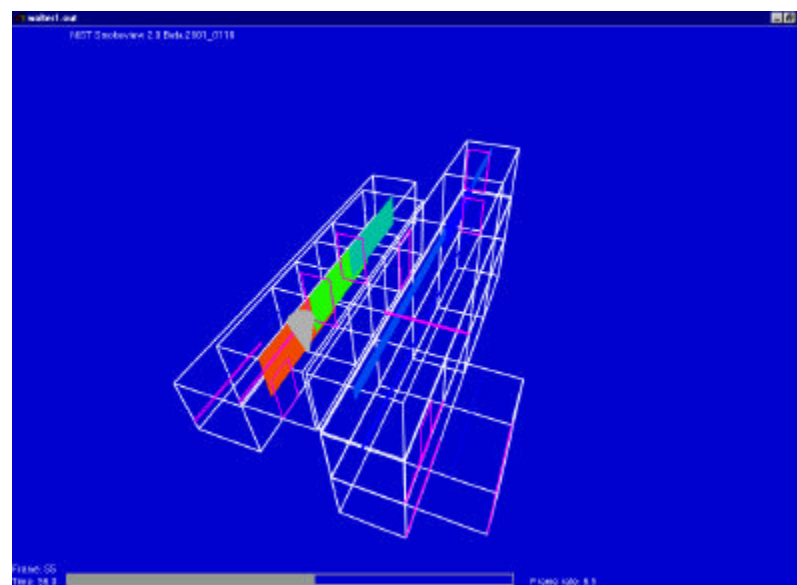
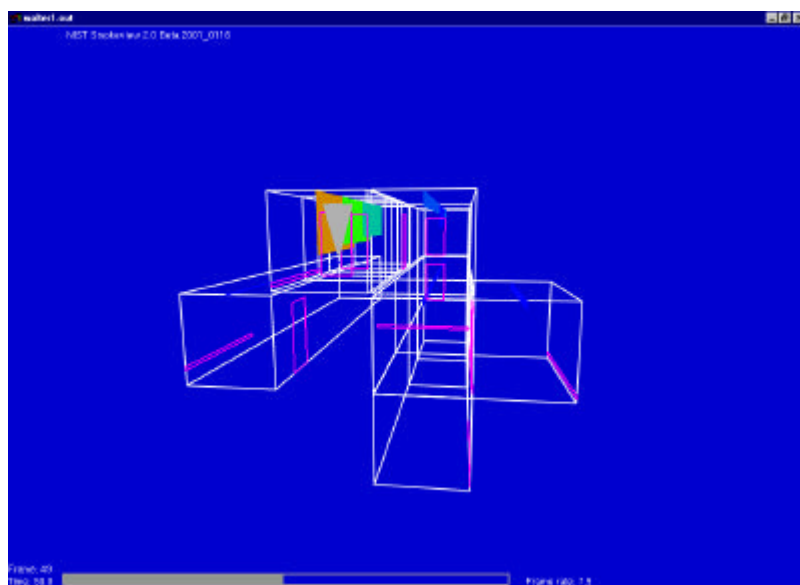
Document: Done





Three views from the Sensor Driven Fire Model

It is a variant of the CFAST
software designed to work
the VCBT (CBS project)



Why is this high reliability?

- **1) Information gathering is redundant**
- **2) Information can be shared by many**
Wired, Wireless, Standard protocols
- **3) Validated algorithm for high likely-hood**
- **4) Metric for assured signal**
- **5) Actual threat**
Insult to people or structure (T, CO, ...)
- **6) Confirmation thru data fusion**
From a single sensor to 10 000 sensors (NIST)

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Why is this important?

- **High reliability implies all relevant information is available when needed**
 - More information → Better decisions
- **Common display format**
 - Wider use, → safer buildings
- **Metric for reliability**
 - “If you cannot measure it, you don’t understand it”
(Lord Kelvin)
- **Public knowledge about contents**